Statistics and Probability

Unit 4, Chapter 1-2: Statistics and Probability

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Sampling

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Objective: Use random sampling to draw inferences about a population.

Suppose you are planning a school dance. You want to select a popular theme to increase student participation. How might you go about determining a popular theme?

To get valid results, a Sample must be chosen very carefully. A Sample is a selected smaller group chosen to represent the larger group, or Population.

Biased samples are **BAD** They are not representative of the population. Often they favor only certain parts of the population. Types of biased samples are:

Convenience sample	Includes members of the population that are easily accessed.	**EX:** Only the soccer team is asked which sport should be played at lunch.
Voluntary sample	Involves only those who want to or can participate in the sampling.	**EX:** Students respond in an email.

Unbiased samples are **"UN"-bad** They are representative of the population because they are selected at random and are large enough to provide accurate data. Types of unbiased samples are:

Simple random sample	Each item/person in a population is as likely as any other to be chosen.	**EX:** Each student's name is written on a piece of paper and drawn from a bowl without looking.
Systematic random sample	The items/people are selected according to a specific time/ item interval.	**EX:** Every 10th student in the lunch line is chosen.

Determine whether each method of sampling is biased or unbiased. Describe the type.

A. To determine the popularity of an actor, a magazine encourages readers to complete an online survey. Biased ☹	**B.** To determine popular genres of music, all people attending a country music festival are surveyed. Biased ☹	**C.** To determine which passenger's bags are to be inspected, every 8th person to check in will be inspected. unbiased ☺

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Depending on the sampling method used, predictions can be made about larger populations. When you make a prediction about a population from a sample of data, you are drawing an inference about that population (It may or may not end up true).

EX: A store sells 3 types of pants: jeans, capris, and cargos. The store workers survey 50 customers at random about their favorite type of pants. The survey responses are indicated at the right. If 450 pairs of pants are ordered, how many should be jeans?

Type	Number
Jeans	25
Capris	15
Cargos	10

$\frac{25j}{50c} = \frac{?j}{450c}$ → $25(450) = 50x$, $11250 = 50x$, $225 = x$

225 jeans should be ordered.

Determine whether each sampling method is valid and make an inference about the population.

D. After finishing their meal, every 5th person that left a restaurant was surveyed about whether they ordered dessert. Out of 20 people, 12 said yes. Is this sampling method valid? If so, how many of 50 people should be expected to order dessert?

Valid ☺

$\frac{12y}{20p} = \frac{xy}{50p}$, $12(50) = 20x$, $\frac{600}{20} = \frac{20x}{20}$, $30 = x$

E. To find out how much money the average American family spends to cool their home, 100 Alaskan families are surveyed at random. 85 said that they spend less than $75 per month on cooling. Is this sampling method valid? If so, how many out of 350 families also spend less than $75 on cooling?

invalid ☹

F. 7 of the 28 students in a math class have the flu. Is this sampling representative of the entire school? If so, how many of the 464 students who attend the school have the flu?

invalid ☹

G. As people leave a concert, every 10th person is surveyed. They are asked if they would buy a t-shirt. 660 of 800 people said no. Is this method of sampling valid? If so, how many people would you expect to buy a t-shirt at the next concert if 7000 attend?

Valid ☺

$\frac{140y}{800p} = \frac{xy}{7000p}$, $140(7000) = 800x$, $\frac{980{,}000}{800}$

1225

Summary:

5

Measures of Center

Objective: Draw informal comparative inferences about populations.

Statistics deal with collecting, organizing, and interpreting data. Mean, median, and mode are measures of center because they are statistics that describe the center of a set of data.

Measure of Center	How to Find it	When to Use it
Mean (average)	Take the sum of the data and divide by the number of items in the data set.	Data has no extreme values. = **EX:** similar values
Median medium	Find the middle number of the data when ordered from least to greatest.	Data has extreme values, but there are no gaps in the middle of the data. **EX:** salaries
Mode most	Identify the number(s) that occur most often. Data may not have a mode, or may have several.	Data has many numbers that repeat **EX:** shoes

Find the mean, median, and mode from the following data sets.

A. The table shows the forecasted weather for Temecula over the next week.

Day	Temp.
Tues	86
Wed	84
Thurs	70
Fri	53

53, 70 | 84, 86

Mean: 73 Median: 77 Mode: X

B. The table shows the number of students in Ms. B's math classes.

Period	# of Students
1	25
2	35
5	29
6	37
7	29

25, 29, 29, 35, 37

Mean: 30 Median: 29 Mode: X

Find the mean, median, and mode from the following data sets. Determine which measure of center best represents the data. 6

C. The table shows the number of sit ups Hadley completed over the past months.

Month	# of Sit Ups
Nov.	2
Dec.	10
Jan.	12
Feb.	30

Mean: 135 Median: 11 Mode: X

D. The table shows a department store's shoe sales by size.

Size	# Sold
8	5
8.5	7
9	10
10	8

8,8,8,8,8
8.5,8.5,8.5,
8.5,8.5,8.5,8.5
9,9,9,9,9,9,9,9
9,10,10,10,10,10,10
10,10,

Mean: 8.98 Median: 9 Mode: 9

E. The prices, in dollars, of digital cameras are researched as 250, 200, 320, 225, 265, 200.

200, 200, 225, 250, 265, 320

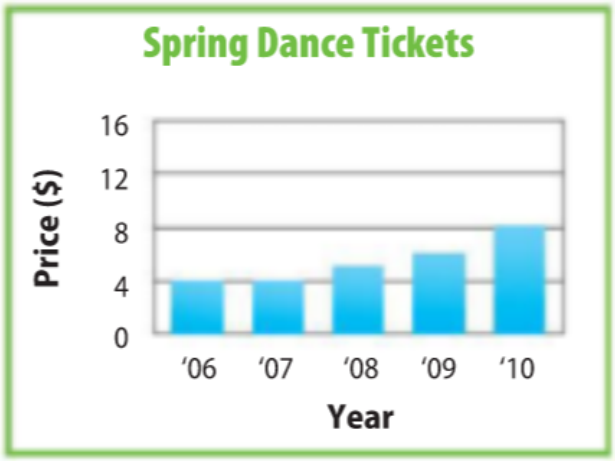
Mean: 245 Median: 242.50 Mode: 200

F. The weekly salaries for the employees at a local book store are \$600, \$625, \$1250, \$1800.

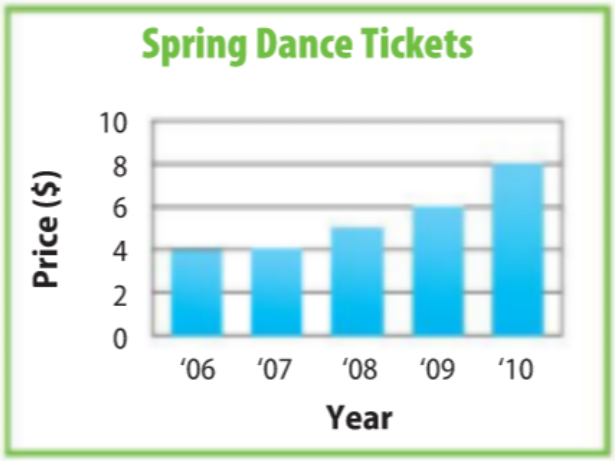
Mean: 1069 Median: 937 Mode: ∅

Summary:

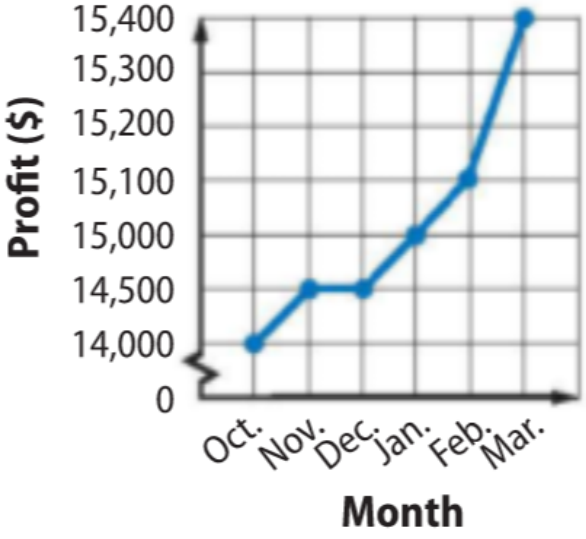
Graph A



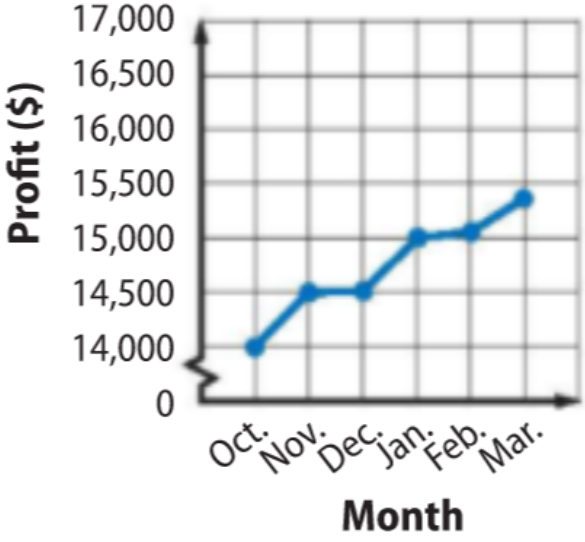
Graph B



Graph A



Graph B



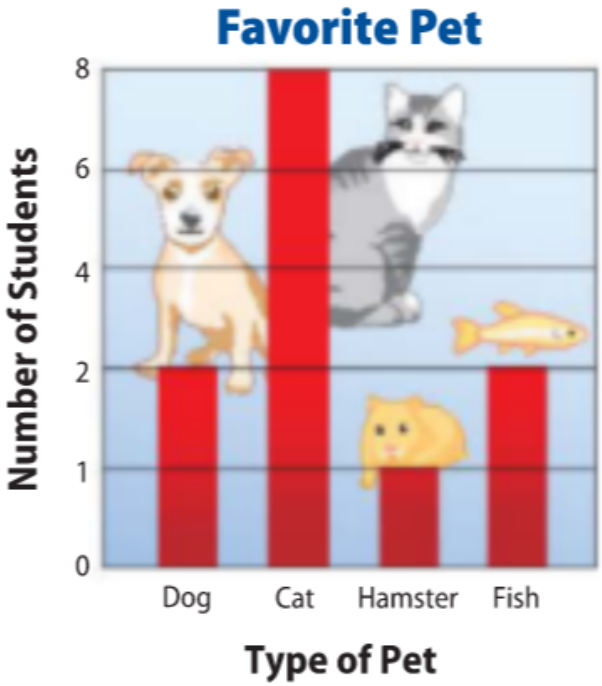
An amusement park boasts that the average height of their roller coasters is 170 feet. Explain how this might be misleading.

Park Roller Coaster Heights	
Coaster	**Height (ft)**
Viper	109
Monster	135
Red Zip	115
Tornado	365
Riptide	126

Find the mean, median, and mode of the sofa prices shown in the table. Which measurement might be misleading in describing the average cost of a sofa? Explain.

Sofa Prices	
Sofa Style	**Cost**
leather	$1,700
reclining	$1,400
DIY assembly	$350
sectional	$1,600
micro-fiber	$1,400


Most Career Wins by a Pitcher
Pitchers
Cy Young
Walter Johnson
Grover Alexander
Christy Mathewson
Jim Galvin
350 400 450 500 550
Wins


Favorite Pet
Number of Students
0
1
2
4
6
8
Dog
Cat
Hamster
Fish
Type of Pet

Measures of Variability

7

Objective: Draw informal comparative inferences about populations.

Measures of variability are used to describe the spread of data. One measure of variability is the range. The range of a set of data is the difference between the greatest and the least values of the set. It describes whether the data is spread out or clustered together.

Find the range of the following data sets.

A. 27, 8, 5, 10, 12 27 - 5 = 22	B. -2, -8, -12, -3, -13 -2 - -13 = 11	C. 17, 9, -1, -3, 4 17 - -3 = 20

In a set of data, the quartiles are the values that divide the data into four equal parts.

EX:

Q1 Q3

1, 1, 1, 2, 2, 2, 3, 3, 4, 4, 4, 5, 5, 6, 18

median

median of lower half is the 1st Quartile or Q1

median of upper half is the 3rd Quartile or Q3

The interquartile range is the range of the middle half of a set of data. It is the difference between the third quartile and the first quartile. A small IQR means the data are close in value and have little variability. A large IQR means the data is more spread out and has greater variability.

IQR = Q3 - Q1

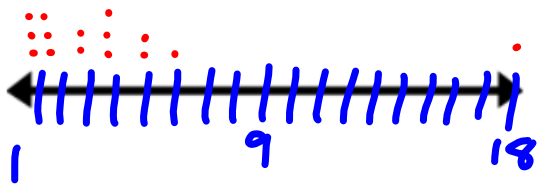
5 - 2 = 3

Data that is more than 1.5 times the value of the IQR beyond the quartiles are called outliers.

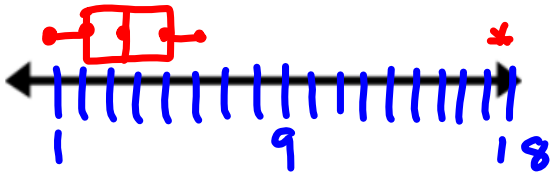
① 3 x 1.5 = 4.5 ③ 5 + 4.5 = 9.5

② 2 - 4.5 = -2.5

As a dot plot, this data looks like:



As a box plot, the data looks like:



Divide each set of data into quartiles. Find the IQR and any outliers. Also, represent the data as a box plot.

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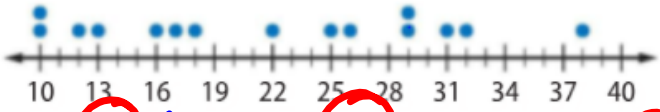
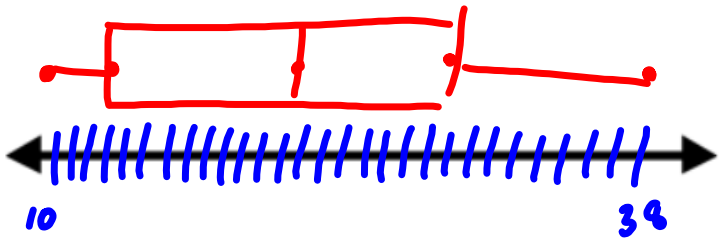
D. The number of minutes spent studying are shown on the dot plot.

Study Time (minutes)



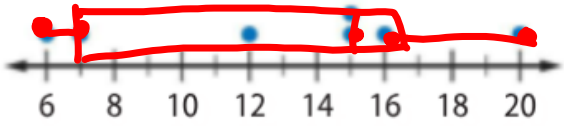
10, 10, 12, 13, 16, 17, 18, 22, 25, 26, 29, 29, 31, 32, 38

min Q1 med. Q3 max



E. The number of years for animal life spans is shown on the dot plot.

Animal Life Spans (years)



6, 7, 12, 15, 15, 16, 20

min – 6
Q1 – 7
med – 15
Q3 – 16
max – 20

Summary:

Mean Absolute Deviation

9

Objective: Draw informal comparative inferences about populations.

You have found measures of center to describe the middle of a set of data, and you have used the interquartile range to describe the spread of a set of data. The mean absolute deviation (also known as _____) is the average distance between each data value and the mean.

EX: Record class data for the number of windows in each student's home.

Steps of MAD	Work
1. MEAN: Find the mean of that data set.	
2. Absolute: Find the distance (always positive) of each data item from the mean.	
3. Deviation: Find the average distance each point is from the mean, by taking the distances (found in Step 2) and finding their mean.	

You can compare the mean absolute deviations for two data sets. A data set with a greater mean absolute deviation has data values that are more spread out from the mean than a data set with a smaller mean absolute deviation.

Compare the data set from Period and Period (see back board).

Steps of MAD	Work for Period	Work for Period
1. MEAN: Find the mean of that data set.		
2. Absolute: Find the distance (always positive) of each data item from the mean.		
3. Deviation: Find the average distance each point is from the mean, by taking the distances (found in Step 2) and finding their mean.		

Which class has the greater MAD? What does this mean for that class?

Summary:

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Common Core Georgia Performance Standards Framework Teacher Edition
Seventh Grade Mathematics • Unit 4

SE Learning Task: Shakespeare vs. Harry Potter

Many skeptics feel that there has been a "dumbing down" of America's youth of the past decades. To determine if there is any truth to this claim, we will compare two pieces of literature: Shakespeare's *Macbeth* and JK Rowling's *Harry Potter and the Chamber of Secrets*.

Is there a difference in the length of the words used in a Shakespeare play compared to a Harry Potter book? Today you will sample words from both pieces of literature to determine who used longer words.

Below are excerpts from a Shakespeare Novel and a Harry Potter book.
Follow the steps below to determine which piece of literature uses longer words.

1. Roll a number cube once for each line of *Macbeth* below. Move to the word that corresponds to the number you roll (1 = first word in the line, 2 = second word in the line, etc.).
2. Count the letters in that word, and record the number in the table below in the "Letter Count" columns.

1. *Is this a dagger which I see before me,*
2. *The handle toward my hand? Come, let me clutch thee!*
3. *I have thee not, and yet I see thee still.*
4. *Art thou not, fatal vision, sensible*
5. *To feeling as to sight, or art thou but*
6. *A dagger of the mind, a false creation,*
7. *Proceeding from the heat oppressed brain?*
8. *I see thee yet, in form as palpable*
9. *As this which now I draw.*
10. *Though marshal'st me the way I was going;*
11. *And such an instrument I was to use.*
12. *Mine eyes are made the fools o' th' other senses,*
13. *Or else worth all the rest. I see thee still;*
14. *And on thy blade and dugeon gouts of blood,*
15. *Which was not so before. There's no such thing.*

Shakespeare:

Line Number	Letter Count	Line Number	Letter Count
1		9	
2		10	
3		11	
4		12	
5		13	
6		14	
7		15	
8			

3. Now, roll the number cube to see which words you will count in the Harry Potter excerpt. You will count the letters in two words from each line. Roll the die and move to the word that corresponds to that number. After counting the number of letters in that word, roll the dice again and move to another word in the same line. Then, move to the next line and repeat the process for each of the lines in the passage. Record your numbers in the chart that follows in the "Letter Count" columns.

1. *October arrived, spreading a damp chill over the grounds and into the*
2. *castle. Madam Pomfrey, the nurse, was kept busy by a sudden*
3. *spate of colds among the staff and students. Her Pepperup potion*
4. *worked instantly, though it left the drinker smoking at the ears for*
5. *several hours afterward. Ginny Weasley, who had been looking*
6. *pale, was bullied into take some by Percey. The steam pouring from*
7. *under her vivid hair gave the impression that her whole head was on fire.*

Harry Potter:

Line Number	Letter Count Word 1	Letter Count Word 2
1		
2		
3		
4		
5		
6		
7		

1
2
3
4
5
6
7

4. Find the mean ($\bar{x}$) of the Shakespeare word sample and the Harry Potter word sample. Do this by adding the letter counts for both passages, separately. Then divide the sum for each passage by the total number of words (15 for Shakespeare; 14 for Harry Potter).

Shakespeare mean ($\bar{x}$) =_____ Harry Potter mean ($\bar{x}$) =_____

X

5. Find the Mean Absolute Deviation of the Shakespeare data using the table below.

a) Find the distance that each value is away from the mean ($\bar{x}$).

b) Determine the absolute value of each deviation from the mean.

c) Total the values from the Mean Absolute Deviation column.

Shakespeare:

Line #	Letter Count	Deviation from Mean($\bar{x}$) Letter Count- ($\bar{x}$)	Mean($\bar{x}$) Absolute Deviation | Letter Count- ($\bar{x}$) |
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10			
11			
12			
13			
14			
15			
			Total:

d) Divide by the number of values counted

5. Find the Mean Absolute Deviation of the Harry Potter data using the table below.
   a. Find the difference between each letter count value and the mean ($\bar{x}$).
   b. Determine the absolute value of each deviation from the mean.
   c. Total the values from the Mean Absolute Deviation column.

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Harry Potter:

Line #	Letter Count	Deviation from Mean($\bar{x}$) Letter Count- ($\bar{x}$)	Mean($\bar{x}$) Absolute Deviation | Letter Count- ($\bar{x}$) |
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			
13.			
14.			
			Total:

d. Divide the total by the number of values counted.

7. Find the five number summary using the data you found for Shakespeare and Harry Potter. Enter your data into the table below:

Shakespeare		Harry Potter	
Minimum		Minimum	
Q1		Q1	
Median		Median	
Q3		Q3	
Maximum		Maximum	

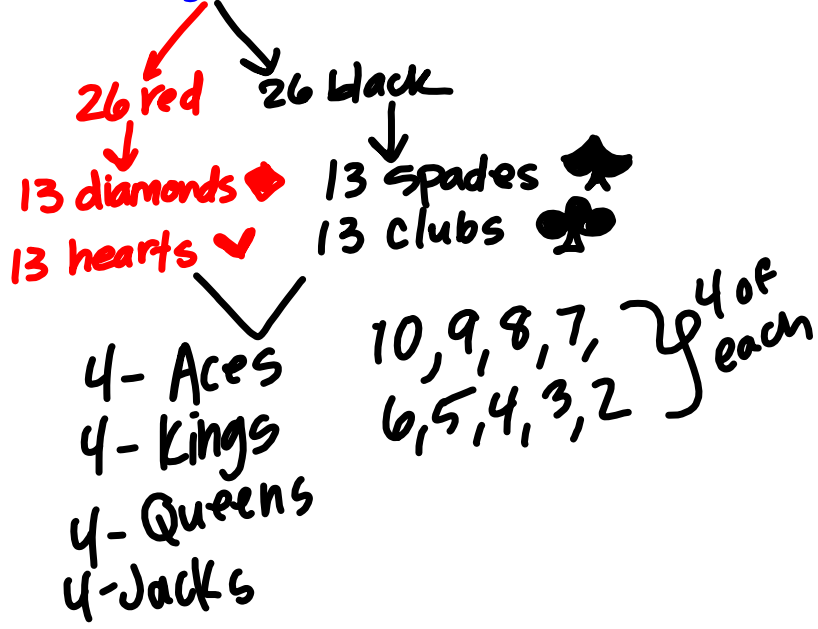
8. Create a box plot for the word counts you found for Shakespeare and Harry Potter. Make sure to label your number line:

9. Looking at the box plots and the mean, would you agree that there has been a "dumbing down" of America's youth over the past decades? Support your answer with numerical data you found in steps #4-8.

10. Do you believe the comparison above could help you conclude the word counts for ***ALL*** Harry Potter and Shakespeare Literature? Why or why not?

Deck of cards

52



Probability of Simple Events

Objective: Investigate chance processes and develop, use, and evaluate probability models.

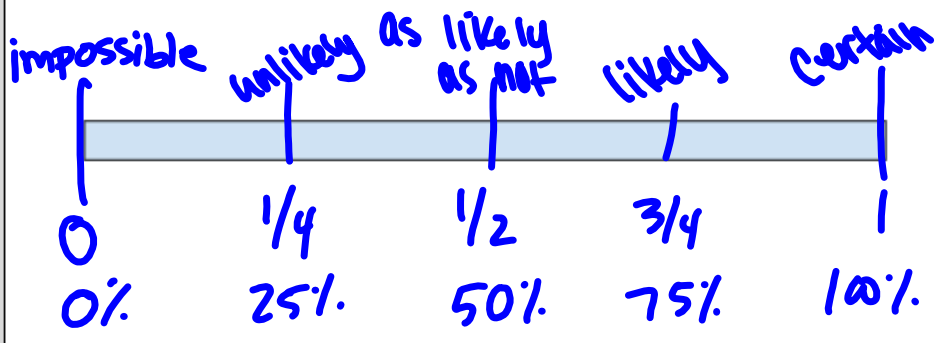
Probability

Probability is the chance that some event will occur. A simple event is one outcome or a collection of outcomes. An outcome is a result. The set of all possible outcomes is called the sample space.

The probability of an event is a ratio that compares the number of favorable outcomes to the number of possible outcomes.

$$P(\text{event}) = \frac{\#\text{ of favorable outcomes}}{\#\text{ of possible outcomes}}$$

The probability of an event is a number between 0 and 1 that expresses the likelihood of the event occurring. The closer a probability is to 1, the more likely it is to occur.



Express each probability as a fraction. Then describe the likelihood of the event.

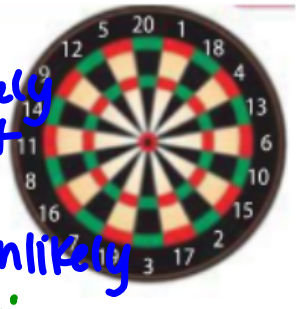
The probability of pulling a queen from a standard deck of cards.	The probability of rolling a prime number on a number cube.	The probability of selecting a vowel from the word MATHEMATICS.
$P(\text{Queen}) = \frac{4}{52} = \frac{1}{13}$	$P(\text{prime}) = \frac{3}{6} = \frac{1}{2}$	$P(\text{vowel}) = \frac{4}{11}$
	vs. composite	vs. consonants

aeiou

Finding the Complement	Complementary events are two events in which either one or the other must happen, but they cannot happen at the same time. **EX:** A coin can either land on heads or not land on heads. The sum of the probability of an event and its complement is 1 or 100 %. P(heads) + P(not heads) = 1 1/2 1/2 **EX:** A bag contains 7 pink, 2 white, and 6 blue marbles. One marble is selected without looking. Find P(not blue). 6/15 + 9/15 = 15/15

Practice: A dartboard like the one shown is divided into 20 equal sections. Determine the probability of each outcome if a dart is equally likely to land anywhere on the dartboard. Express each probability as a fraction. Then describe the likelihood of the event.

1. P(20) 1/20, unlikely
2. P(odd) 1/2, as likely as not
3. P(greater than 16) 1/5 unlikely
4. P(less than 21) 1/1 certain
5. P(even) 1/2 as likely as not
6. P(greater than 20) 0, impossible
7. P(not 4, 5, or 6) 17/20, likely
8. P(not 20) 19/20, likely
9. P(not odd) 1/2 as likely as not
10. P(not composite) unlikely 9/20
11. P(multiple of 3) 3/10, unlikely
12. P(at least 13) 2/5 unlikely
13. P(1 or 2) 1/10, unlikely
14. P(greater than 0) 1/1 certain



Summary:

Theoretical vs. Experimental Probability

Objective: Investigate chance processes and develop, use, and evaluate probability models.

$\frac{1}{12}$

Theoretical Probability	Theoretical Probability is based on uniform probability, that is what should happen when conducting a probability experiment.
$\frac{2}{12}$ **Experimental Probability**	Experimental Probability is based on relative frequency that is what actually happens when conducting a probability experiment.

The theoretical and experimental probability of an event may or may not be the same. However, as the number of attempts increase, the theoretical and experimental probability should become equal in value.

$\frac{3}{22} \approx 13\%$ $\frac{12}{83} \approx 14\%$ $\frac{4}{21}, \frac{2}{12}, \frac{1}{6}, \frac{1}{7}, \frac{1}{15}, \frac{3}{22}$

Try It: Your provided spinner is divided into 4 equal sections:
What is the theoretical probability of spinning the spinner and landing on yellow?

$P(\text{yellow}) = \frac{1}{4}$, 25%.

If the spinner was spun 20 times, how many times should it land on that same color?

$\frac{1}{4} = \frac{5}{20}$ 5 times

Spin your spinner 20 times, record the color it lands on after each spin.

1.	2.	3.	4.	5.
6.	7.	8.	9.	10.
11.	12.	13.	14.	15.
16.	17.	18.	19.	20.

What is your experimental probability for landing on yellow? How does this compare to the theoretical probability?

If the spinner was spun 20 more times (40 times total), how many times should it land on that same color according to the original theoretical probability?

How many times should it land on that same color according to your recent experimental probability?

Conduct your experiment 20 more times.

21.	22.	23.	24.	25.
26.	27.	28.	29.	30.
31.	32.	33.	34.	35.
36.	37.	38.	39.	40.

P. 1+3 4161/1760 = 26% yellow

What is your experimental probability for landing on _____ now? How does this compare with your theoretical probability?

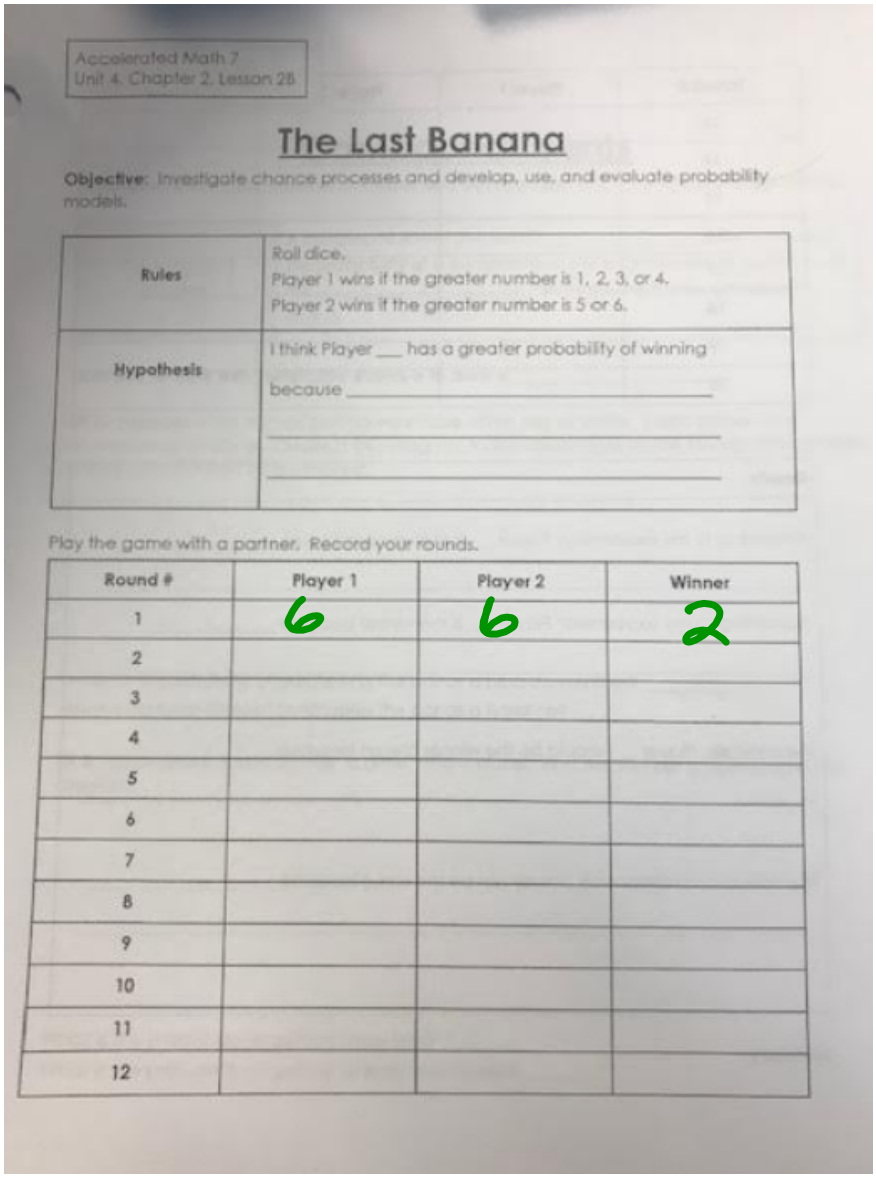
How does it compare with your predicted experimental probability?

250/1000 = 25%

113/500 = 22% 137/500 = 27%

Summary:

https://www.youtube.com/watch?v=Kgudt4PXs28



Accelerated Math 7
Unit 4, Chapter 2, Lesson 2B

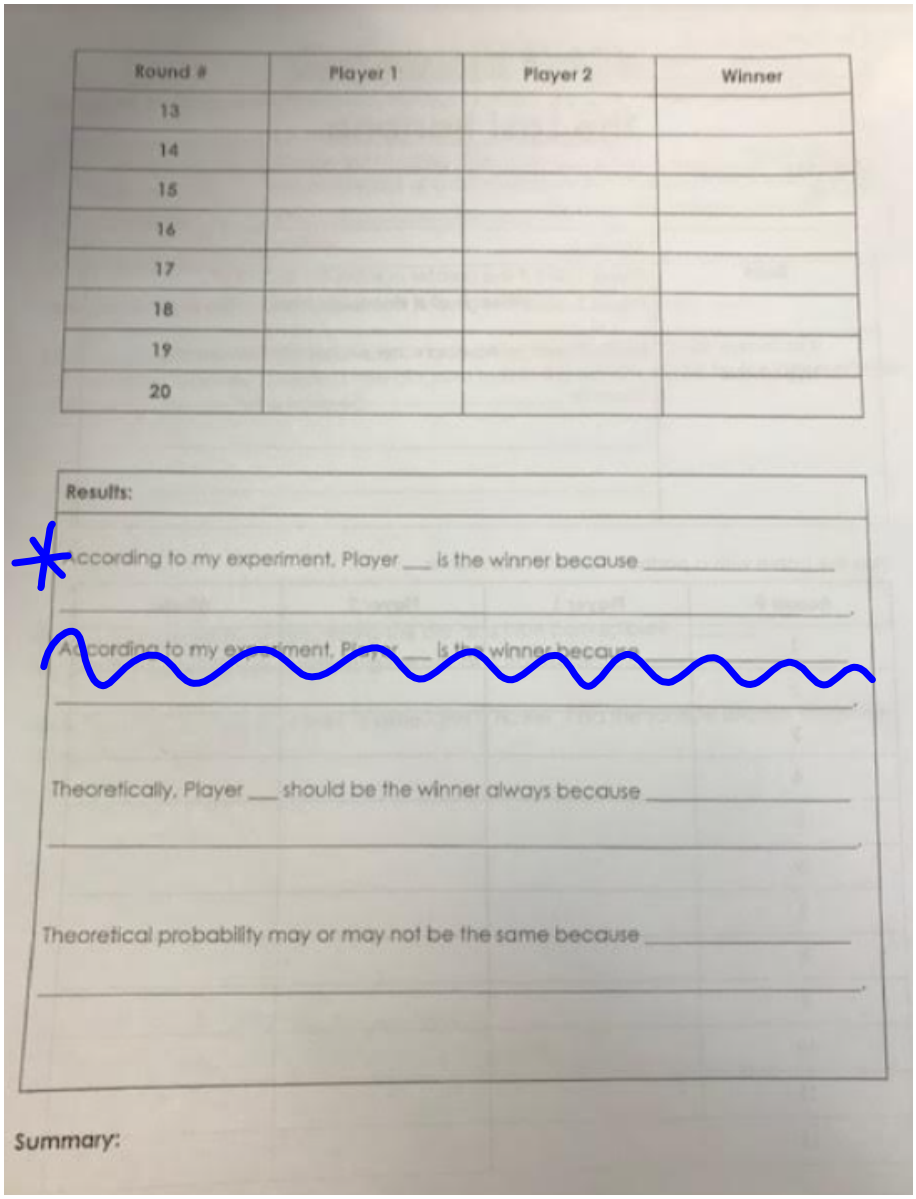
The Last Banana

Objective: Investigate chance processes and develop, use, and evaluate probability models.

Rules	Roll dice. Player 1 wins if the greater number is 1, 2, 3, or 4. Player 2 wins if the greater number is 5 or 6.
Hypothesis	I think Player ___ has a greater probability of winning because _____ _____ _____

Play the game with a partner. Record your rounds.

Round #	Player 1	Player 2	Winner
1	6	6	2
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			



Round #	Player 1	Player 2	Winner
13			
14			
15			
16			
17			
18			
19			
20			

Results:

According to my experiment, Player ___ is the winner because _____

_____.

According to my experiment, Player ___ is the winner because _____

_____.

Theoretically, Player ___ should be the winner always because _____

_____.

Theoretical probability may or may not be the same because _____

_____.

Summary:

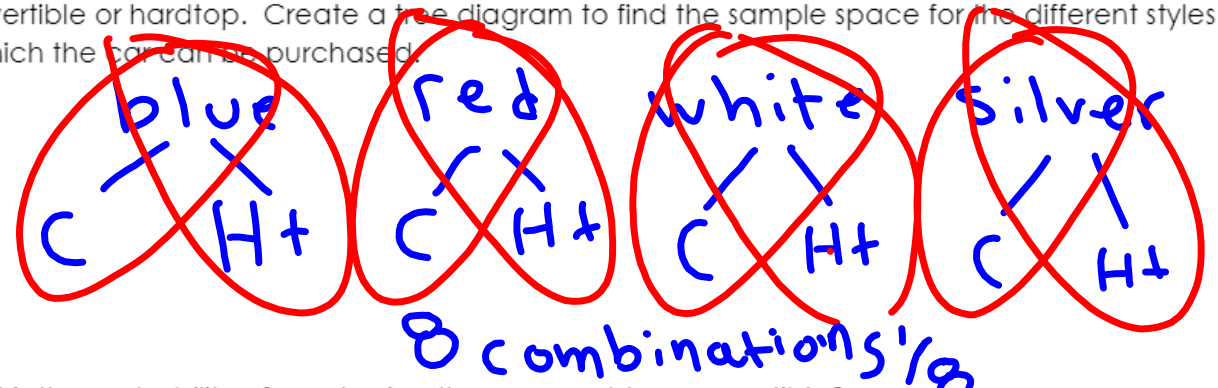
Compound Events

Objective: Investigate chance processes and develop, use, and evaluate probability models.

Compound Events	A compound event consists of 2 or more simple events. The probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.

One way to work with compound events is to draw a tree diagram.

EX A: Suppose a car can be purchased in blue, silver, red, or white. It also comes as a convertible or hardtop. Create a tree diagram to find the sample space for the different styles in which the car can be purchased.

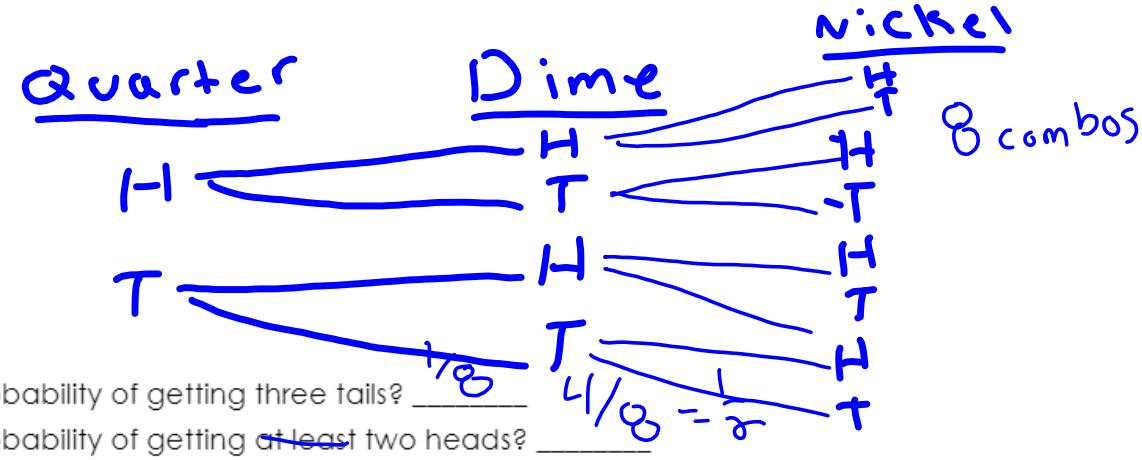


8 combinations 1/8

What is the probability of purchasing the car as a blue convertible? 1/8

What is the probability of purchasing the car as a hardtop? 4/8 = 1/2

(B: Suppose you toss a quarter, a dime, and a nickel. Find the sample space using a tree agram.



hat is the probability of getting three tails? 1/8

hat is the probability of getting ~~at least~~ two heads? 4/8 = 1/2

Another way to work with compound events is by making a list.

EX C: Suppose students are assigned a temporary password the first time they visit the computer lab. If temporary passwords consist of a letter (A, B, or C), followed by a number (1 or 2), followed by a letter (X, Y, or Z), how many different temporary passwords are there?

A1X A2X B1X B2X C1X C2X
A1Y A2Y B1Y B2Y C1Y C2Y
A1Z A2Z B1Z B2Z C1Z C2Z

18 combos 3·2·3 = 18 Counting Principle

The last way to work with compound events is the Fundamental Principle**. This states that if event M can occur in m ways and is followed by event N that can occur n ways, then the event M followed by event N can occur in** m x n **ways.**

EX D: Suppose you are playing a game that involves first spinning a spinner with four equal sections (blue, green, red, and yellow), and then flipping a coin. How many possible outcomes are there?

$4 \cdot 2 = 8$

EX E: Suppose two number cubes are rolled. How many possible outcomes are there?

$6 \cdot 6 = 36$

What is the probability that the sum of the numbers on the cubes is 12? 1/36

1 2 3 4 5 6 + 6 12

Summary:

NAME _____ DATE _____

Lesson 8 Extra Practice

Probability of Compound Events

Use any method to find the total number of outcomes in each situation.

1. choosing an ice cream cone from waffle, plain, or sugar and a flavor of ice cream from chocolate, vanilla, or strawberry

2. choosing one math class from Algebra and Geometry and one foreign language class from French, Spanish, or Latin

3. making a sandwich from white, wheat, or rye bread, cheddar or Swiss cheese, and ham, turkey, or roast beef

4. choosing a car that comes in white, black, or red with standard or automatic transmission and with a 4-cylinder or 6-cylinder engine

Each spinner is spun once. Find each probability.

5. *P*(red and even)

6. *P*(purple and less than 7)

7. *P*(blue and prime)

8. *P*(blue or orange and odd)

9. *P*(green and greater than 3)

NAME _____ DATE _____ PERIOD _____

Lesson 8 Skills Practice

Probability of Compound Events

Draw a tree diagram to find the number of outcomes for each situation.

1. Three coins are tossed.

2. A number cube is rolled and a coin is tossed.

Find the total number of outcomes in each situation.

3. One card is drawn from a standard deck of cards.

4. Three six-sided number cubes are rolled.

5. One coin is flipped three consecutive times.

6. One coin is flipped and one eight-sided die is rolled.

7. A sweater comes in 3 sizes and 6 colors.

8. A restaurant offers dinners with a choice each of two salads, six entrees, and five desserts.

Find each probability.

9. Draw the ace of spades from a standard deck of cards.

10. A coin is tossed twice. What is the probability of getting two tails?

11. Draw the six of clubs from a standard deck of cards.

12. Roll a 4 or higher on a six-sided number cube.

13. Roll a 7 or an 8 on an eight-sided die.

14. Roll an even number on an eight-sided die.

15. Draw a club from a standard deck of cards.

16. Roll an odd number on a six-sided number cube.

17. A coin is tossed and an eight-sided die is rolled. What is the probability that the coin lands on tails, and the die lands on a 2?

18. A coin is tossed and a card is drawn from a standard deck of cards. What is the probability of landing on tails and choosing a red card?

Dependent Events

Objective: Investigate chance processes and develop, use, and evaluate probability models.

9 marbles

Ms. B has a jar of 5 blue marbles, 3 green marbles, and 1 red marble. The probability you pull a blue marble is 5/9. The probability that your classmate then pulls a green marble is 3/8.

Independent Events	When one event does not affect the outcome of the other event, the events are independent events. For example, if you toss a coin twice, the first toss has no effect on the second toss.
Dependent Events	If the outcome of one event affects the outcome of another event, the events are dependent events. For example, you have a bag with blue and green marbles. You pick one marble, do not replace it, and pick another one.

Find the probability of the following dependent events.

16 fruits

1. There are 4 oranges, 7 bananas, and 5 apples in a fruit basket. Ben selects a piece of fruit at random. Then Cindy selects a piece of fruit at random.

A. Find the probability that two apples are chosen.

$\frac{5}{16} \times \frac{4}{15} = \frac{20}{240} = \frac{2}{24} = \frac{1}{12}$

B. Find the probability that two bananas are chosen.

$\frac{7}{16} \times \frac{6}{15} = \frac{42}{240} = \frac{7}{40}$

$\frac{1}{4} \times \frac{1}{3} = \frac{1}{12}$

C. Find the probability that an orange, then apple is chosen.

$\frac{4}{16} \times \frac{5}{15} = \frac{20}{240} = \frac{1}{12}$

2. Ms. B's class has 2 students with blue eyes, 3 students with green eyes, 4 students with hazel eyes, and 20 students with brown eyes. Two students are selected at random.

29 students

A. P(green then blue)

$\frac{3}{29} \times \frac{2}{28} = \frac{6}{812} = \frac{3}{406}$

B. P(two blue)

$\frac{2}{29} \times \frac{1}{28} = \frac{2}{812} = \frac{1}{406}$

C. P(hazel then blue)

$\frac{4}{29} \times \frac{2}{28} = \frac{8}{812} = \frac{2}{203}$

D. P(brown then blue)

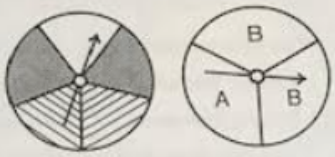
$\frac{20}{29} \times \frac{2}{28} = \frac{40}{812} = \frac{10}{203}$

EC

What Do the Police Put On a Bad Pig?

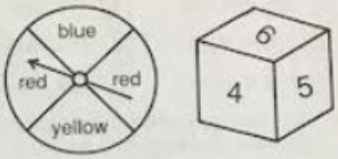
Cross out the box containing each correct answer. (If an answer appears more than once, it doesn't matter which one you cross out.) When you finish, write the letters from the remaining boxes in the spaces at the bottom of the page.

I. Find each probability if you spin both spinners.



(1) P(white, A) (2) P(white, B)
(3) P(striped, A) (4) P(striped, B)
(5) P(not striped, A) (6) P(not striped, B)
(7) P(not white, A) (8) P(not white, B)

II. Find each probability if you spin the spinner and roll the number cube.



(9) P(blue, 2) (10) P(blue, not 2)
(11) P(yellow, even) (12) P(red, even)
(13) P(not blue, 5) (14) P(not blue, odd)
(15) P(red, 4) (16) P(red, not 4)

III. Find each probability if you pick one marble, replace it, then pick a second marble.

(17) P(black, white) (18) P(black, striped)
(19) P(white, striped) (20) P(not white, striped)
(21) P(black, black) (22) P(striped, striped)
(23) P(white, not white) (24) P(not white, not white)

IV. Solve.

(25) A test has two multiple choice questions, each with five choices. What is the probability of guessing the correct answer to both questions?

(26) One letter is randomly selected from the word *MATH*, and a second letter is randomly selected from the word *JOKES*. What is the probability that both letters are vowels?

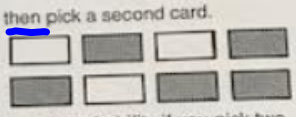
A	T	T	N	O	H	E	E	A	T	P	P	I	M	G	C	O
$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{5}$	$\frac{1}{6}$	$\frac{1}{7}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{9}$	$\frac{1}{10}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{15}$	$\frac{1}{16}$	$\frac{1}{18}$	$\frac{1}{20}$	$\frac{1}{24}$
T	H	O	U	G	S	S	L	F	A	E	E	F	A	T	S	E
$\frac{1}{25}$	$\frac{1}{36}$	$\frac{2}{5}$	$\frac{2}{7}$	$\frac{2}{9}$	$\frac{2}{15}$	$\frac{2}{15}$	$\frac{3}{8}$	$\frac{3}{10}$	$\frac{4}{9}$	$\frac{4}{15}$	$\frac{4}{15}$	$\frac{5}{8}$	$\frac{5}{12}$	$\frac{5}{24}$	$\frac{7}{15}$	$\frac{8}{15}$

PIC 4-d: Independent Events E-52 MIDDLE SCHOOL MATH WITH PIZZAZZ! BOOK E

What Do You Get if a Bunch of Bad Guys Fall in the Ocean?

Cross out the box containing each correct answer. (If an answer appears more than once, it doesn't matter which one you cross out.) When you finish, write the letters from the remaining boxes in the spaces at the bottom of the page.

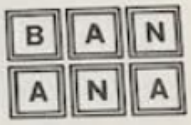
I. Find each probability if you pick a card, do *not* replace it, then pick a second card.



(1) P(black, then white) (2) P(black, then black)

(3) P(white, then black) (4) P(white, then white)

II. Each letter of the word *BANANA* is written on a card. Find each probability if you pick two cards without replacing the first.



(5) P(B, then N) (6) P(B, then A) (7) P(N, then B)

(8) P(N, then A) (9) P(A, then B) (10) P(A, then N)

(11) P(N, then N) (12) P(A, then A) (13) P(B, then B)

III. Find each probability if you pick a marble, do not replace it, then pick a second marble. (R = red; B = blue; G = green)

(14) P(blue, then green) (15) P(green, then red)

(16) P(green, then green) (17) P(green, then not green)

(18) P(red, then blue) (19) P(red, then not blue)

(20) P(blue, then blue) (21) P(not blue, then not blue)

IV. Solve.

(22) There were 6 purple socks and 4 orange socks in a drawer. Zucky picked one sock without looking and then another without looking (or replacing the first). What is the probability that he picked 2 purple socks?

(23) There are 10 boxes in a grab bag. The boxes are identical except that 7 of them contain $20 bills. A contest winner gets to pick two boxes from the grab bag. What is the probability of getting two $20 bills?

TH	AN	IT	IT	IT	PL	AC	ES	EY	EY	ON	ON	RI	DE
0	$\frac{1}{3}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{6}$	$\frac{1}{8}$	$\frac{1}{9}$	$\frac{1}{10}$	$\frac{1}{10}$	$\frac{1}{12}$	$\frac{1}{12}$	$\frac{1}{14}$	$\frac{1}{15}$
DE	DE	SO	ME	ET	WA	TE	AM	LL	RS	VE	RY	ST	ST
$\frac{1}{15}$	$\frac{1}{15}$	$\frac{1}{36}$	$\frac{2}{5}$	$\frac{3}{28}$	$\frac{4}{9}$	$\frac{5}{12}$	$\frac{5}{14}$	$\frac{5}{18}$	$\frac{7}{15}$	$\frac{7}{18}$	$\frac{7}{36}$	$\frac{15}{56}$	$\frac{15}{56}$